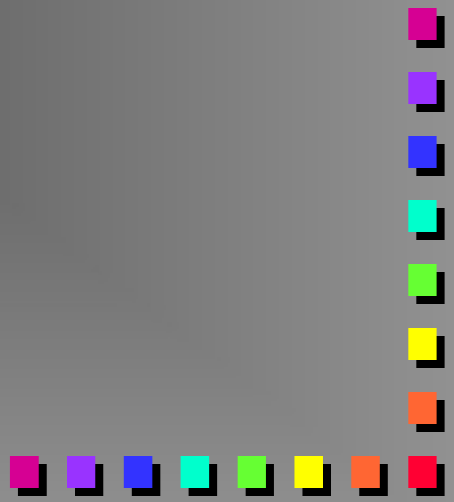
Airway & Ventilation Management

Overview

- **Signs of adequate/inadequate breathing**
- **Infant & child anatomy considerations**
- **Artificial ventilation**
- **Opening the airway**
- **Techniques of artificial ventilation**

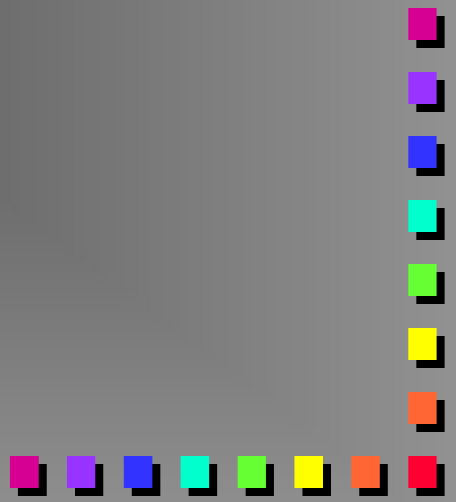
Overview

- **Airway adjunctsOxygen**
- **Techniques of suctioning**
- **Equipment for oxygen delivery**
- **Special Considerations**



Adequate Breathing

- Normal Rate
  - Adult: 12 - 20/min
  - Child: 15 - 30/min
  - Infant: 25-50/min
- Rhythm
  - regular
  - irregular



Adequate Breathing

- Quality
  - Breath sounds - present & equal
  - Chest expansion - adequate & equal
  - Minimum effort of breathing - use of accessory muscles (predominantly in infants & children
- Depth (tidal volume) - adequate

Inadequate Breathing

- Rate - outside of normal ranges
- Rhythm - irregular
- Quality
  - Breath sounds - diminished or absent
  - Chest expansion - unequal or inadequate
  - Increased effort of breathing - use of accessory muscles (predominantly in infants & children)

Inadequate Breathing

- Depth - inadequate/shallow
- The skin may be pale or cyanotic & cool and clammy
- There may be retractions above the clavicles, between the ribs and below the rib cage, especially in children

Inadequate Breathing

- Nasal flaring may be present
- In infants, there may be “seesaw” breathing
- Agonal respirations (occassional gasping breaths) may be seen just before death

Infant & Child Anatomy Considerations

- Mouth and nose - smaller and more easily obstructed than in adults
- Pharynx - tongues take up proportionally more space in the mouth than adults

Infant & Child Anatomy Considerations

- Trachea (windpipe)
  - Narrow which makes is easily obstructed by swelling
  - Softer and more flexible
- Cricoid Cartilage - **less developed & less rigid**
- Diaphragm - **chest wall is softer, tend to depend heavily on the diaphragm for breathing**

Artificial Ventilation

- Adequate artificial ventilation occurs when:
  - Chest rises & falls with each artificial ventilation
  - The rate is sufficient (12 per min for adults & 20 per min for infants and children)
  - Heart rate returns to normal with successful artificial ventilation

Artificial Ventilation

- Artificial ventilation is inadequate when:
  - The chest does not rise & fall with artificial ventilation
  - The rate is too slow or too fast
  - Heart rate does not return to normal with artificial ventilation

Opening The Airway

- Head-tilt chin-lift when no neck injury is suspected
- Jaw thrust when EMT-Basic suspects spinal injury
- Assess need for suctioning

Techniques of Artificial Ventilation

- Order of preference, the methods for ventilating a patient by the EMT-B
  - Mouth-to-mask
  - Two person bag-valve mask
  - Flow-restricted, oxygen-powered ventilation device
  - One-person bag-valve mask

Techniques of Artificial Ventilation

- Body substance isolation
- Mouth-to-mouth - **review techniques learned in BLS course**

Techniques of Artificial Ventilation

- Mouth-to-mask
  - Performed using a pocket face mask – made of soft, collapsible material
  - Can be carried in your pocket, jacket, or purse
  - Made of a clear plastic, which allows you to observe the patient's mouth and nose for vomiting or secretions that need to be suctioned

Techniques of Artificial Ventilation

- Mouth-to-mask
  - **Infection control features**
    - Ventilations delivered through a valve- no direct contact with the patient's mouth
    - One-way valve that prevents the patients exhaled air from coming back through the valve

Techniques of Artificial Ventilation

- Mouth-to-mask
  - Oxygen inlets- when oxygen is attached to the inlet, an oxygen concentration of approximately 50% is delivered
  - Mouth-to-Mask Technique
    - Position yourself at the patients head & open airway
    - If necessary, clear airway of obstructions

Techniques of Artificial Ventilation

- Mouth-to-mask
  - Mouth-to-Mask Technique
    - Insert an oropharyngeal (OP) airway to MOA
    - Add oxygen, 15 lpm - if oxygen is not immediately available, do not delay ventilations
    - Position mask on patient’s face
      - Apex (top of the triangle) is over the bridge of nose
      - The base is between the lower lip & prominence of the chin

Techniques of Artificial Ventilation

- Mouth-to-mask
  - Mouth-to-Mask Technique
    - Hold the mask firmly in place while maintaining the proper head tilt
    - Take a deep breath & exhale into the mask port-watch for the patient's chest to rise
    - Remove your mouth from the port & allow for passive exhalation. Continue as you would for mouth-to-mouth ventilation's or CPR

Techniques of Artificial Ventilation

- Bag-valve mask (BVM)
  - Consist of:
    - Self-inflating bag
    - One-way valve
    - Face mask
    - Oxygen reservoir
  - Needs to be connected to oxygen to perform most effectively

Techniques of Artificial Ventilation

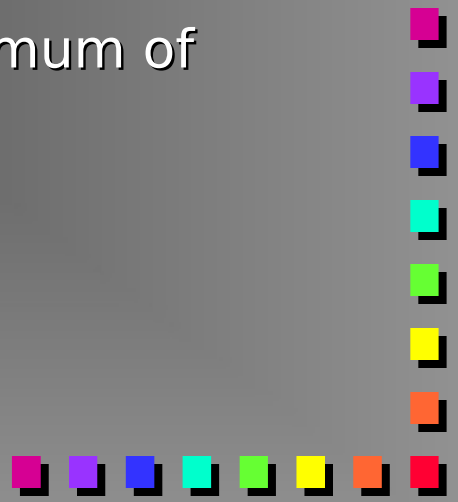
- Bag-valve mask (BVM)
  - BVM Issues
    - It has a volume of approximately 1,600 ml
    - It provides less volume that mouth-to-mask
    - Single EMT-B may have difficulty maintaining an airtight seal

Techniques of Artificial Ventilation

- Bag-valve mask (BVM)
  - BVM Issues
    - Two EMT-B are more effective
    - Position self at top of patient's head for optimal performance
    - Adjunctive airways may be necessary

Techniques of Artificial Ventilation

- Bag-valve mask (BVM)
  - BVM Issues
    - BVM should have:
      - A self-refilling bag that is easily cleaned & sterilized
      - Non-jam valve that allows a maximum of oxygen inlet flow of 15 lpm
      - No pop-off valve
      - Standardized 15/22mm fillings



Techniques of Artificial Ventilation

- Bag-valve mask (BVM)
  - BVM Issues
    - BVM should have:
      - Oxygen inlet & reservoir to allow for high concentration of oxygen
      - A true valve for non-rebreather
      - Ability to perform in all environmental conditions & temperature extremes
      - Available in infant, child, & adult sizes

Techniques of Artificial Ventilation

- BVM - Use when no trauma is suspected
  - Open airway & select correct mask size
  - Position & create a mask to face seal using the proper techniques (two person & one person)
  - Have assistant squeeze bag with two hands, if alone, maintain seal and squeeze bag
  - Repeat, a minimum of every 5 sec for adults & every 3 sec for children and infants

Techniques of Artificial Ventilation

- BVM - Use when no trauma is suspected
  - If chest does not rise & fall, reevaluate
    - Chest does not rise - reposition head
    - Air is escaping from under the mask - reposition fingers & mask
    - Check of obstruction
    - Chest still does not rise & fall - use alternative method
    - Consider use of adjuncts

Techniques of Artificial Ventilation

- BVM - Use with suspected trauma
  - Open airway & select correct mask size
  - Immobilize head & neck
    - Have assistant hold head manually
    - or use your knees to prevent movement

Techniques of Artificial Ventilation

- BVM - Use with suspected trauma
  - Position & create a mask to face seal using the proper techniques (two person & one person)
  - Use ring & little fingers to bring jaw up to mask without tilting head or neck
  - Have assistant squeeze bag with two hands, if alone, maintain seal and squeeze bag
  - Repeat, a minimum of every 5 sec for adults & every 3 sec for children and infants

Techniques of Artificial Ventilation

- BVM - Use with suspected trauma
  - If chest does not rise, reevaluate
    - If abdomen rises - reposition jaw
    - Air escaping from under the mask - reposition fingers & mask
    - Check for obstruction
    - If chest still does not rise - use alternative method
    - Consider use of adjuncts

Techniques of Artificial Ventilation

- Flow-restricted, oxygen-powered ventilation devices (OPVD)
  - OPVD for use with adults only
  - Should provide:
    - Peak flow rate of 100% oxygen at up to 40 lpm
    - Inspiratory pressure relief valve that opens at approximately 60 cm water & vents any remaining volume to the atmosphere or ceases gas flow

Techniques of Artificial Ventilation

- OPVD
  - Should provide:
    - Audible alarm that sounds whenever the relief valve pressure is exceeded
    - Satisfactory operation under ordinary environmental conditions & extremes of temperature
    - A trigger positioned so that both hands of the EMT-B can remain on the mask

Techniques of Artificial Ventilation

- OPVD
  - Use when no neck injury in suspected
    - Follow steps for BVM
  - Use when there is suspected neck injury
    - Follow steps for BVM

Techniques of Artificial Ventilation

- Bag to stoma or tracheostomy tube
  - Definition: **tracheostomy-an artificial permanent opening in the trachea**
  - If unable to ventilate
    - Try suction
    - Then ventilate through mouth & nose
    - Sealing stoma may improve ability to ventilate from above or may clear obstruction

Techniques of Artificial Ventilation

- Bag to stoma or tracheostomy tube
  - Need to seal the mouth & nose when air is escaping when ventilating at the stoma
  - BVM to stoma-use infant & child mask to make seal.
  - Technique very similar to ventilating through mouth.
  - Head and neck do not need to be positioned

Airway Adjuncts

- Oropharyngeal (OP) Airways
  - OP airways may be used to assist in maintaining an open airway on unresponsive patients without a gag reflex.
  - **Patients with a gag reflex will vomit**
  - Select the proper size - measure from the corner of the patient’s lips to the bottom of the earlobe or angle of jaw

Airway Adjuncts

- Oropharyngeal (OP) Airways
  - Open the patient's mouth
  - In adults, to avoid obstructing the airway with the tongue-insert the airway upside down, with the tip facing toward the roof of the patient's mouth

Airway Adjuncts

- Oropharyngeal (OP) Airways
  - Advance the airway gently until resistance is encountered
  - Turn the airway 180 degrees so that is comes to rest with the flange on the patient’s teeth.

Airway Adjuncts

- Oropharyngeal (OP) Airways
  - Another method:
    - Insert the airway in right side up
    - use a tongue depressor to press the tongue down and forward to avoid obstructing the airway
    - This is the preferred method for airway insertion in an infant or child.

Airway Adjuncts

- Nasopharyngeal (NP) Airways
  - NP airways are less likely to stimulate vomiting
  - May be used on patients who are responsive but need assistance keeping the tongue from obstructing the airway

Airway Adjuncts

- Nasopharyngeal (NP) Airways
  - Even though the tube is lubricated, this is a painful stimulus
  - Select the proper size:
    - Measure from the tip of the nose to the tip of the patient’s ear
    - Also consider diameter of airway in the nostril

Airway Adjuncts

- Nasopharyngeal (NP) Airways
  - Select the proper size:
    - Lubricate NP with a water-soluble lubricant
    - Insert it posteriorly
    - Bevel should be toward the base of the nostril or toward the septum
  - If the airway cannot be inserted into one nostril, try the other nostril

Techniques For Suctioning

- BSI
- Purpose
  - Remove blood, other liquids & food particles from the airway
  - Some suction units are inadequate for removing solid objects like teeth, foreign bodies and food
  - A patient needs to be suctioned immediately when a gurgling sound is heard with artificial ventilation

Techniques For Suctioning

- Types of units
  - Mounted
  - Portable
    - Electrical
    - Hand operated

Techniques For Suctioning

- Suction catheters
- Hard or rigid (tonsil sucker or tonsil tip)
  - Used to suction the mouth & oropharynx of an unresponsive patient
  - Should be inserted only as far as you can see
  - Use rigid catheter for infants & children, but take caution not to touch back of airway

Techniques For Suctioning

- Suction catheters
  - Soft (French)
    - Useful for suctioning the nasopharynx and in other situations where a rigid catheter cannot be used
    - Should be measured so that it is inserted only as for as the base of the tongue.

Techniques For Suctioning

- Use
  - Suction device should be inspected on a regular basis
  - A properly functioning unit with a gauge should generate 300 mmHg vacuum
  - A battery-operated unit should have a charged battery

Techniques For Suctioning

- Use
  - Turn on the suction unit
  - Attach a catheter
    - Use rigid catheter when suctioning mouth of an infant or child
    - When suctioning nasal passages use a bulb suction or french catheter with low to medium suction
  - Insert catheter into oral cavity without suction and only to the base of the tongue

Techniques For Suctioning

- Use
  - Apply suction and move the catheter tip side to side
  - Suction for no more than 15 seconds at a time
    - Shorter time for infants and children
    - If the patient has secretions or emesis that cannot be removed quickly and easily, log roll and the oropharynx should be cleared

Techniques For Suctioning

- Use
  - If patient produces frothy secretions as rapidly as suctioning can remove
    - Suction for 15 seconds
    - Artificially ventilate for two minutes
    - Then suction for 15 seconds, and continue in this manner
    - Consult medical direction
  - Rinse the catheter and tubing with water

Supplemental Oxygen

- Oxygen cylinders- come in different sizes
  - D cylinder has 350 liters
  - E cylinder has 625 liters
  - M cylinder has 3000 liters
  - G cylinder has 5300 liters
  - H cylinder has 6900 liters

Supplemental Oxygen

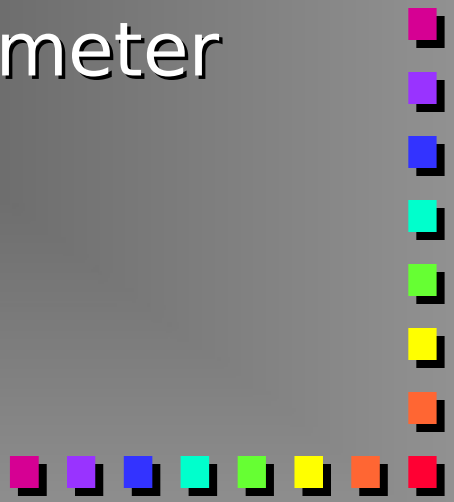
- Handle carefully since contents are under pressure
- Tanks should be positioned to prevent falling & blows to the valve-gauge assembly
- Secured during transport

Supplemental Oxygen

- Pressure regulators
  - Full tank approximately 2000 psi - varies with ambient temperature
  - Dry oxygen not harmful in short term - humidifier needed only for patient on oxygen for a long time.

Supplemental Oxygen

- Operating procedures
  - Remove protective seal
  - Quickly open, then shut, the valve
  - Attach regulator-flowmeter to tank
  - Attach oxygen device to flowmeter



Supplemental Oxygen

- Operating procedures
  - Open flowmeter to desired setting
  - apply oxygen device to patient
  - When complete, remove device from patient
  - Then turn off valve and remove all pressure from the regulator

Supplemental Oxygen

- Nonrebreather
  - Is the preferred method of giving oxygen to prehospital patients
  - can deliver up to 90% oxygen
  - Nonrebreather bag must be full before mask is placed on patient
  - Flow rate should be adjusted so that when patient inhales, bag does not collapse (15 lpm)

Supplemental Oxygen

- Nonrebreather
  - Patients who are cyanotic, cool, clammy, or short of breath need oxygen.
  - Concerns about the dangers of giving too much oxygen to patients with a Hx of COPD & infants and children have not been shown to be valid in the prehospital setting

Supplemental Oxygen

- Nonrebreather
  - Patients with chronic obstructive pulmonary disease and infants & children who require oxygen should receive high-concentration oxygen

Supplemental Oxygen

- Nonrebreather
  - Nonrebreather mask comes in different sizes for adult, children, & infants
  - Be sure to select the correct size

Supplemental Oxygen

- Nasal Cannula
  - Rarely the best method of delivering adequate oxygen to the prehospital patient
  - Should be used only when patients will not tolerate a nonrebreather mask

Special Considerations

- Patients with Laryngectomies (Stomas)
  - A breathing tube may be present - if it is obstructed, suction it
  - Some patients have partial stomas
    - If, upon artificially ventilating stoma, air escapes from the mouth and nose
    - Close the mouth & pinch the nostrils

Special Considerations

- Infant & child patient
  - Place in correct neutral position for the infant and extend a little past neutral for a child
  - Avoid excessive hypeerextension of the head
  - Avoid excessive bag pressure-use only enough to make chest rise

Special Considerations

- Infant & child patient
  - Ventilate with bag-valve mask until adequate chest rise occurs
    - Do not use pop-off valve
    - It must be disabled in order to adequately ventilate child or infant

Special Considerations

- Infant & child patient
  - Gastric distention is more common in children
  - An oral or nasal airway may be considered when other procedures fail to provide a clear airway

Special Considerations

- Facial injuries
  - Because blood supply to the face is so rich, blunt injuries to the face frequently result in severe swelling
  - For the same reason, bleeding into the airway from facial injuries can be a challenge to manage

Special Considerations

- Obstructions
  - Use foreign-body airway obstruction (FBAO) procedures learned in BLS training
  - When foreign-body airway obstruction presists, EMT-Bs should
    - perform three cycles of the FBAO procedure
    - Then transport
    - Continuing the FBAO procedure en route

Special Considerations

- Dental appliances
  - Ordinarily dentures should be left in place
  - Partial dentures (plates) may become dislodged during an emergency - leave in place, but be prepared to remove if it becomes dislodged

Summary

- **Signs of adequate/inadequate breathing**
- **Infant & child anatomy considerations**
- **Artificial ventilation**
- **Opening the airway**
- **Techniques of artificial ventilation**

Summary

- **Airway adjunctsOxygen**
- **Techniques of suctioning**
- **Equipment for oxygen delivery**
- **Special Considerations**